Improving Decision-Making Activities for Malaria and Meningitis Risk Mapping Integration of NASA Products/ Platforms (SERVIR) and UN WHO Open Health

FEASIBILITY project April 2011 – August 2012

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Columbia University

Objective 1

Develop user-friendly interface which allow non-experts in remote sensing to:

- *Visualize,*
- *Analyze,*
- *Extract time series of information,*
- *Download*

Climatic and Environmental Data derived from Remotely-Sensed products for Malaria and Meningitis

Objective 2

Integrate the data and dynamical maps within:

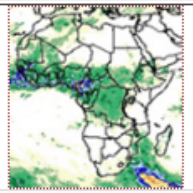
- *NASA SERVIR*
- *UN WHO Open Health/ Vector Control Decision Support*
- *Google Earth*

To improve the accessibility and diffusion of the data to a large community of health practitioners

Data for Malaria

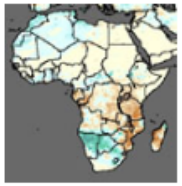
Monitoring Tools for Epidemic Malaria

Malaria Early Warning System



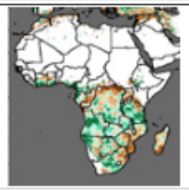
MEWS is a rainfall-monitoring product based on dekadal rainfall estimates from the Climate Prediction Center. The interface allows users to view recent rainfall estimates with a seasonal and recent historical perspective. Time series analyses of rainfall data are generated based on user-selected parameters.

Rainfall Estimate Differences



The Rainfall Estimate Differences (RED) map illustrates the difference between the most recent dekadal rainfall estimates from the Climate Prediction Center and their short term average (from 2000 to last recent complete year). These differences should not be confused with conventional rainfall anomalies, but may provide insight into changes in malaria risk in areas where precipitation anomalies are the principal cause of malaria epidemics by providing a recent historical reference.

Rainfall Estimate Percentages

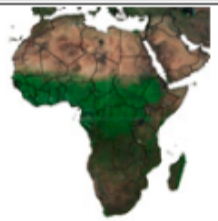


The Rainfall Estimate Percentages (REP) map expresses the most recent dekadal rainfall estimates from the Climate Prediction Center as a percentage of the short term average (from 2000 to last recent complete year).

Rainfall Estimates from USGS/ FEWSNET

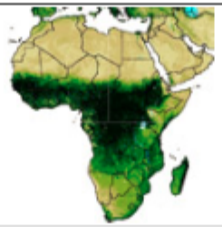
MODIS Vegetation Product 250m spatial resolution (MOD13Q1)

MODIS Image Download Tools



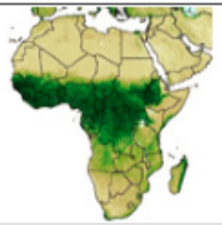
Several regional tools facilitate access to MODIS images, which are provided by the United States Geological Survey. Images are available for West Africa, East Africa, and Southern Africa.

NDVI Analysis Tool



An interactive map of the Normalized Difference Vegetation Index for West Africa, East Africa, and Southern Africa. Time series analyses of NDVI are generated based on user-selected parameters.

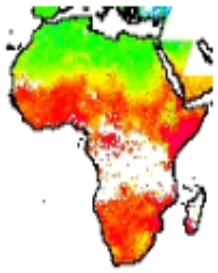
EVI Analysis Tool



An interactive map of the Enhanced Vegetation Index for West Africa, East Africa, and Southern Africa. Time series analyses of EVI are generated based on user-selected parameters.

Two New Data Sets for Malaria Added

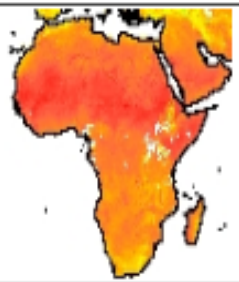
MODIS Nighttime Land Surface Temperature (LST) Analysis Tools



MODIS Nighttime Land Surface Temperature images at 1km resolution, averaged over 8 days. Images come from the Aqua satellite, and are provided by the United States Geological Survey. Images are available for West Africa, East Africa, and Southern Africa. Time series analyses of Land Surface Temperature are generated based on user-selected parameters.

Aqua MODIS LST night to estimate min air Temp.
(Vancutsem, Ceccato et al., 2010)

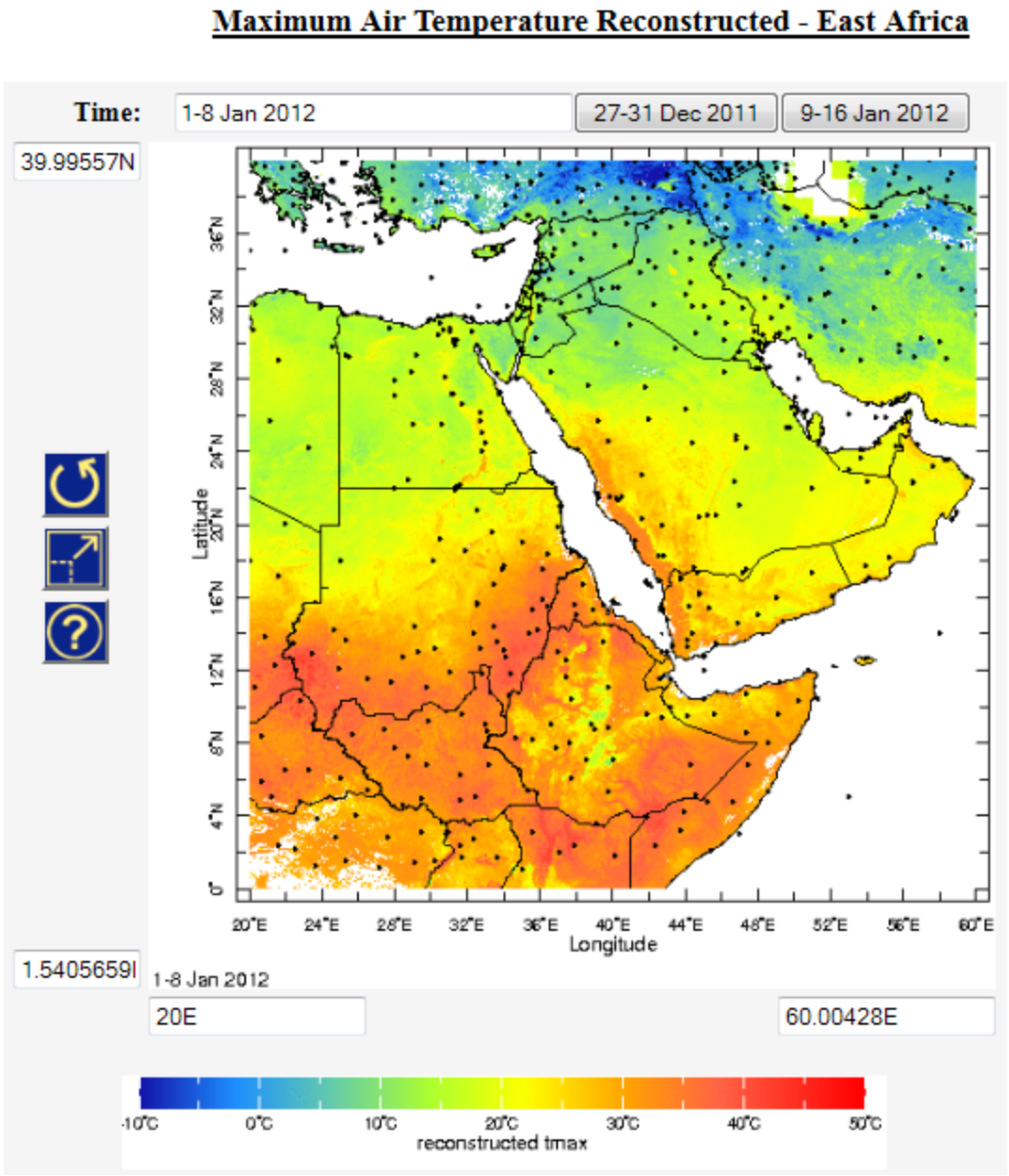
Maximum Air Temperature Reconstructed



Inferred maximum air temperature from space using observations from polar orbiting satellite AQUA-sensor MODIS.

Aqua MODIS LST night and WORDCLIM to estimate max air Temp.
(Ceccato et al., 2010)

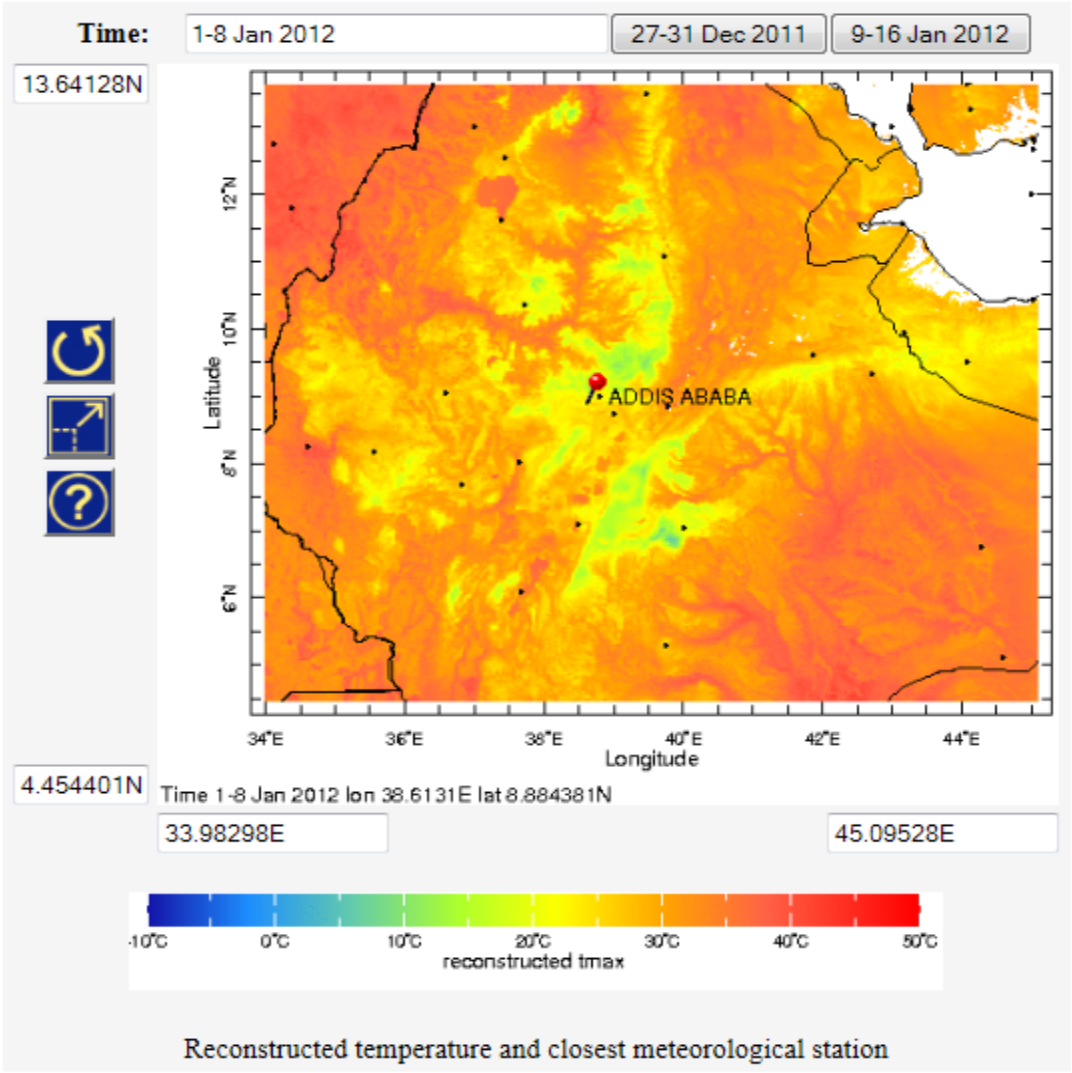
Tools Developed



- Maximum air Temperature estimated from MODIS LST night and WORDCLIM
- Maximum Air Temperature Observed (Data Source: NOAA Climate Prediction Center EVE stations: monthly station max temperature data)

Tools Developed

Maximum Air Temperature Reconstructed - East Africa



Reconstructed temperature and closest meteorological station

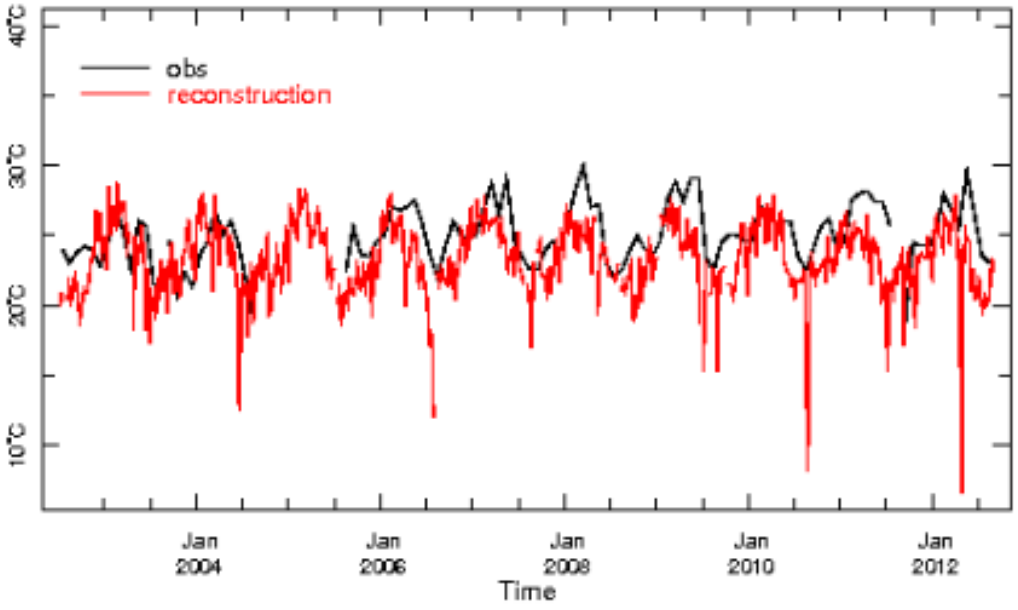
Longitude: 38.79999E
Latitude: 8.98N
Elevation: 2324. m
Name: ADDIS ABABA

Longitude: 38.60984E
Latitude: 8.886053N
Elevation: 2179. m

Tools Developed

Reconstructed temperature and closest meteorological station

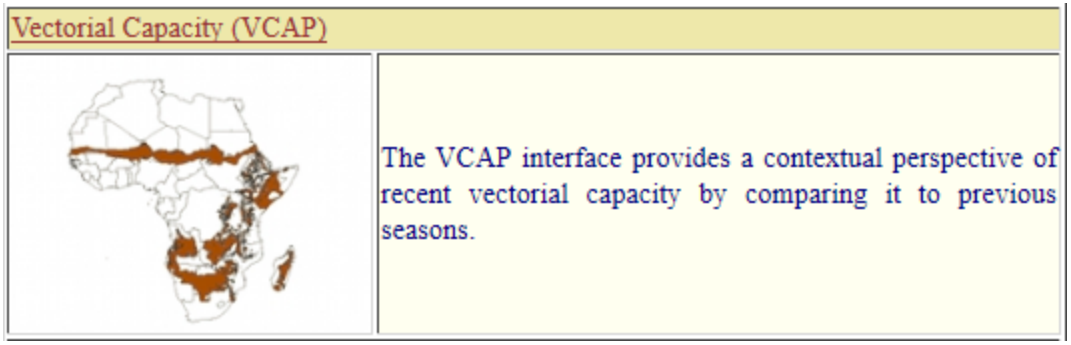
Longitude:	38.79999E
Latitude:	8.98N
Elevation:	2324. m
Name:	ADDIS ABABA



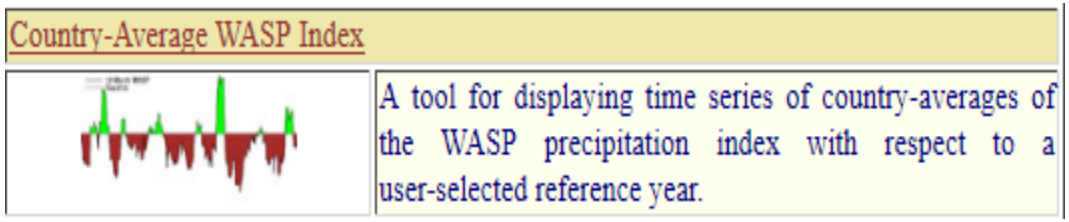
Longitude:	38.60984E
Latitude:	8.886053N
Elevation:	2179. m

download Max temperature reconstructed and Max temperature observed in graph

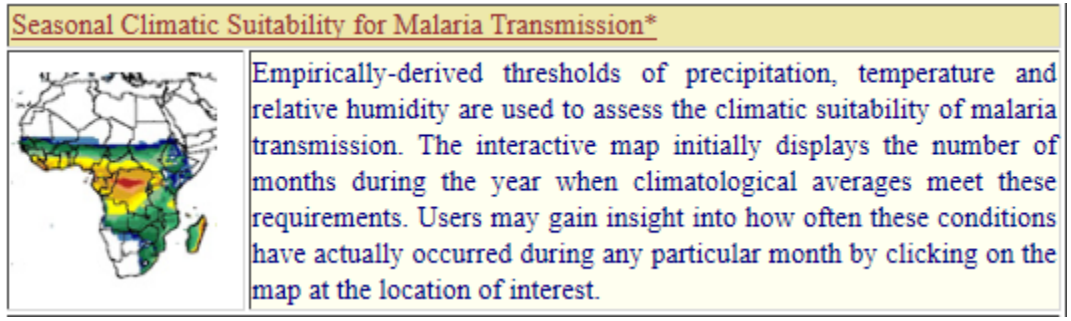
Products for Malaria Added



Vectorial Capacity Model derived from TRMM and MODIS LST data (Ceccato et al., 2012)

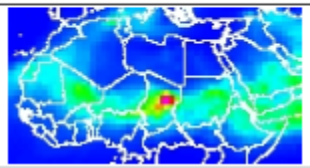


African Country-Average CMAP Weighted Anomaly Standardized Precipitation (WASP) with Selectable Baseline (Lyon and Barnston, 2005)



Seasonal Climatic Suitability for Malaria Transmission (Grover-Kopec et al., 2006)

Data for Meningitis (Monitoring Dust)

Modeling Tools for Epidemic Meningitis	
Regional Dust Model	
	Regional dust model results from 1985-2006, including climate variables, every 3 hours.

Model (NASA GISS)

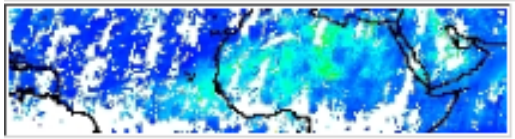
Pérez, C., et al. 2011: Atmospheric dust modeling from meso to global scales with the online NMMB/BSC-Dust model — Part 1: Model description, annual simulations and evaluation. *Atmos. Chem. Phys.*, **11**, 13001-13027

Datasets and variables

accumulated precipitation	home nasa_roses_a19 Dust_model_2011 RegDustModelProjected acprec[X Y | T]
acummulated incoming shortwave at ground	home nasa_roses_a19 Dust_model_2011 RegDustModelProjected aswin[X Y | T]
dust optical depth at 350 nm	home nasa_roses_a19 Dust_model_2011 RegDustModelProjected dust_aod350[X Y | T]
dust optical depth at 550 nm	home nasa_roses_a19 Dust_model_2011 RegDustModelProjected dust_aod550[X Y | T]
accumulated dust emission	home nasa_roses_a19 Dust_model_2011 RegDustModelProjected dust_emi[X Y | T]
dust PM10 10m concentration	home nasa_roses_a19 Dust_model_2011 RegDustModelProjected dust_pm10_sconc10[X Y | T]
dust PM2.5 10m concentration	home nasa_roses_a19 Dust_model_2011 RegDustModelProjected dust_pm25_sconc10[X Y | T]
dust concentration	home nasa_roses_a19 Dust_model_2011 RegDustModelProjected dustsl[X Y | pres T]
height	home nasa_roses_a19 Dust_model_2011 RegDustModelProjected hsl[X Y | pres T]
max 2m temperature	home nasa_roses_a19 Dust_model_2011 RegDustModelProjected maxt2[X Y | T]
min 2m temperature	home nasa_roses_a19 Dust_model_2011 RegDustModelProjected mint2[X Y | T]
surface pressure	home nasa_roses_a19 Dust_model_2011 RegDustModelProjected ps[X Y | T]
2m specific humidity	home nasa_roses_a19 Dust_model_2011 RegDustModelProjected q02[X Y | T]
specific humidity	home nasa_roses_a19 Dust_model_2011 RegDustModelProjected qsl[X Y | pres T]
incoming shortwave at ground	home nasa_roses_a19 Dust_model_2011 RegDustModelProjected rswin[X Y | T]
sea level pressure	home nasa_roses_a19 Dust_model_2011 RegDustModelProjected slp[X Y | T]
2m temperature	home nasa_roses_a19 Dust_model_2011 RegDustModelProjected t2[X Y | T]
temperature	home nasa_roses_a19 Dust_model_2011 RegDustModelProjected tsl[X Y | pres T]
10m u wind	home nasa_roses_a19 Dust_model_2011 RegDustModelProjected u10[X Y | T]
u wind component	home nasa_roses_a19 Dust_model_2011 RegDustModelProjected usl_h[X Y | pres T]
friction velocity	home nasa_roses_a19 Dust_model_2011 RegDustModelProjected ustar[X Y | T]
10m v wind	home nasa_roses_a19 Dust_model_2011 RegDustModelProjected v10[X Y | T]
v wind component	home nasa_roses_a19 Dust_model_2011 RegDustModelProjected vsl_h[X Y | pres T]

Data for Meningitis (Monitoring Dust)

MISR Aerosol Monitoring



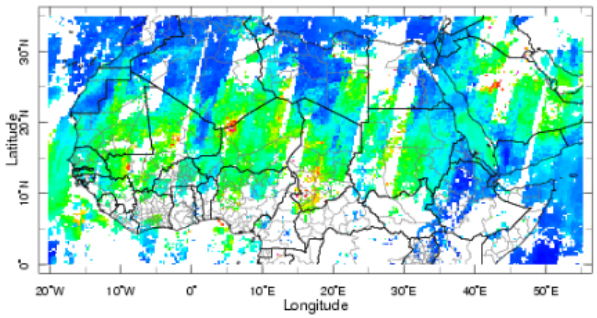
Dekadal Aerosol Optical Thickness (AOT) from 2000-2009

MISR (NASA JPL), Kalashnikova O.

Clickable Map for Aerosol Index Summaries

Time: 21-30 Apr 2009 | 11-20 Apr 2009

35N



Optional Overlay Maps

Boundaries
- Coasts
- Countries
- States
- Districts

Time Series Region

Spatially average data over the following region:
- Country Boundary
- Province Boundary
- District Boundary
- 111x111 km box

0.0 | 21-30 Apr 2009 | 20.25W | 55.25E

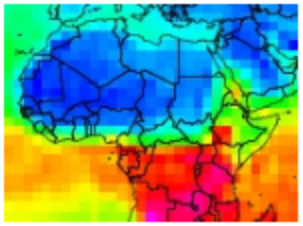
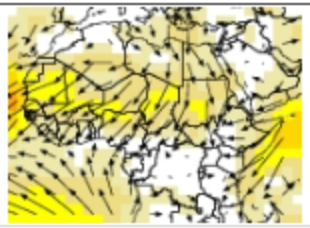
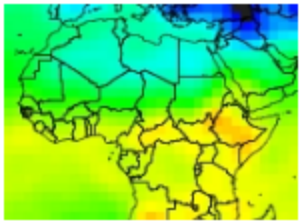
Dataset Documentation

Aerosol Index

Data: Dekadal-average NASA MISR aerosol optical thickness on a 0.25 x 0.25 deg. lat/lon grid. The dekadal average is calculated only if at least 10% of the daily values in a dekad are non-missing.

Download Map		Download Layer		Download Data
Figure as PDF	Figure as JPEG	KML for GoogleEarth	GeoTiff for GIS	Data for GIS
Colorscale as PDF	Colorscale as JPEG			

Data and Products for Meningitis

Specific Humidity Monitoring	
	A specific humidity-monitoring product based on dekadal near-surface specific humidity analyses from the NCEP/NCAR Reanalysis. The interface allows users to view recent specific humidity analyses with a seasonal and recent historical perspective. Time series analyses of specific humidity data are generated based on user-selected parameters.
Wind Monitoring	
	A wind-monitoring product based on dekadal near-surface wind analyses from the NCEP/NCAR Reanalysis. The interface allows users to view recent wind analyses with a seasonal and recent historical perspective. Time series analyses of wind data are generated based on user-selected parameters.
Temperature Monitoring	
	A temperature-monitoring product based on dekadal near-surface temperature analyses from the NCEP/NCAR Reanalysis. The interface allows users to view recent temperature analyses with a seasonal and recent historical perspective. Time series analyses of temperature data are generated based on user-selected parameters.

NCEP-NCAR

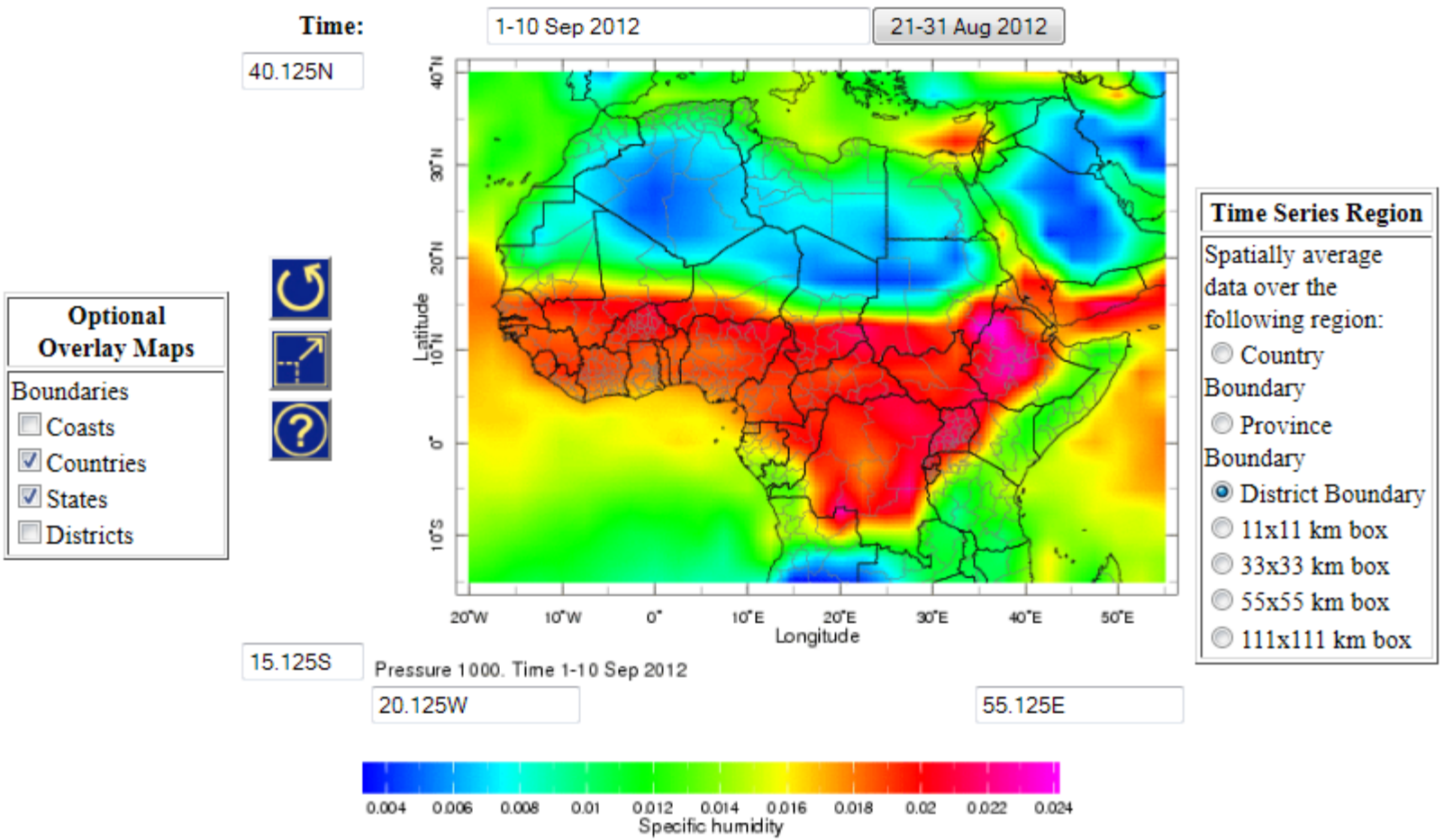
Kalnay, et al., 1996. The NCEP/NCAR 40-Year Reanalysis Project. Bulletin of the American Meteorological Society.

Data and Products for Meningitis

NASA-ROSES - Dekadal Specific Humidity on an Interactive Map

This interface provides a contextual perspective of recent specific humidity by comparing it to previous seasons and the 1979-2008 average. More information about how to use the interface is available here.

Clickable Map for Specific Humidity Summaries

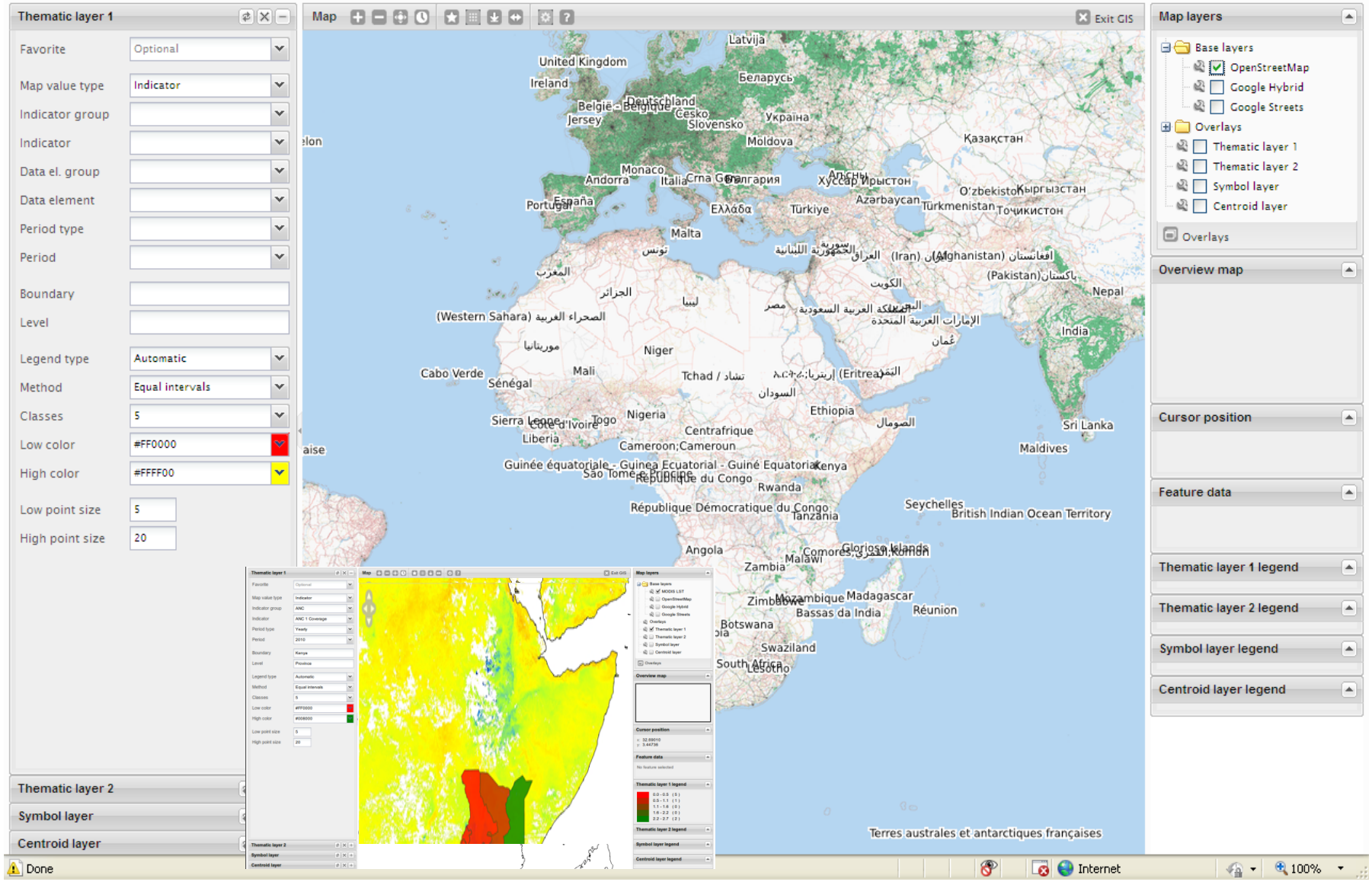


Integration within Open Health, SERVIR, Google Earth

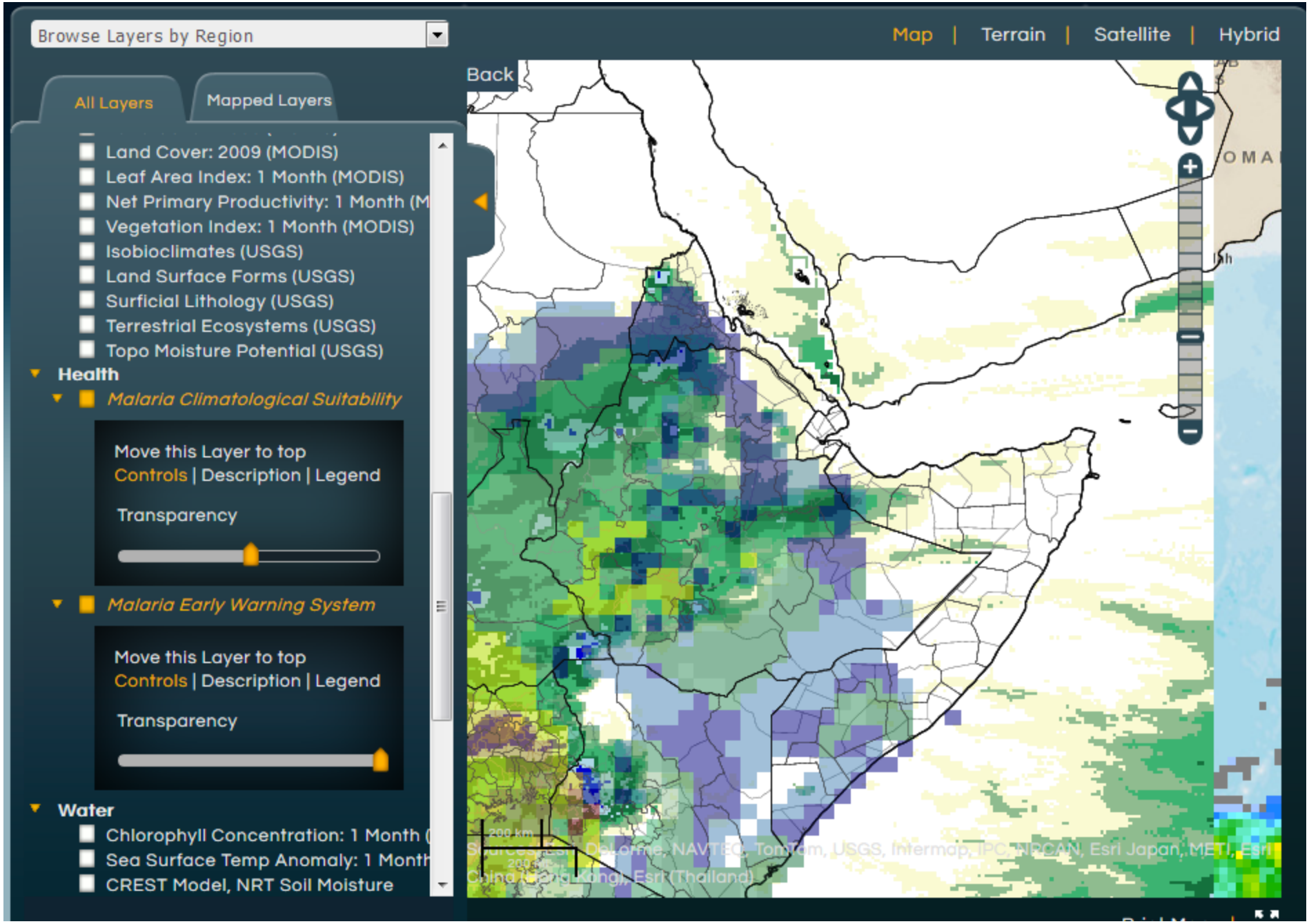
- Translated IRI Map Room pages into layers for WMS and KML (Google Earth)
- Created metadata according to the Geonetwork catalog standard used by Open Health making the Maproom information searchable
- Constructed access points for the KML

Integration IRI Malaria Products within WHO-AFRO

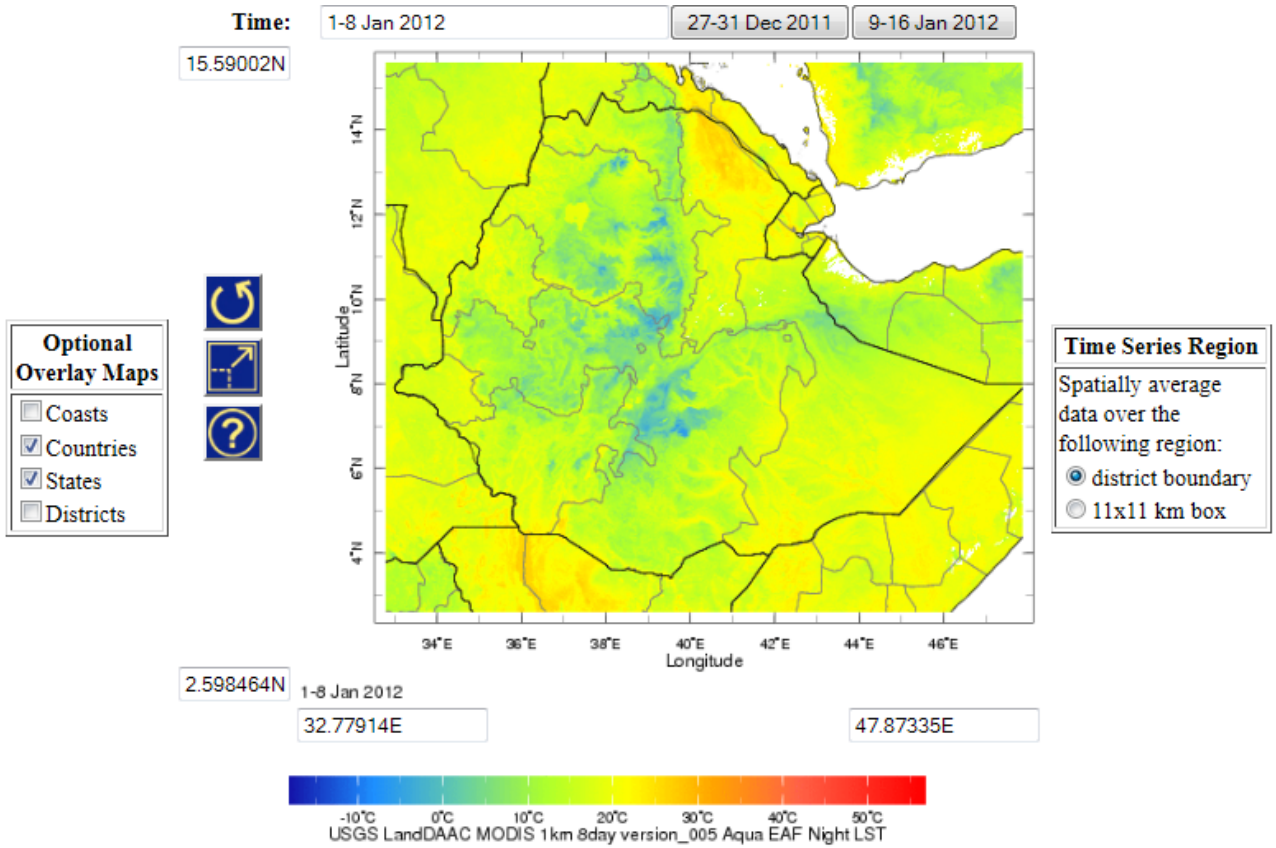
Vector Control Decision Support



SERVIR Integration


Browse Layers by Region
Map | Terrain | Satellite | Hybrid
Back
All Layers
Mapped Layers
Land Cover: 2009 (MODIS)
Leaf Area Index: 1 Month (MODIS)
Net Primary Productivity: 1 Month (M
Vegetation Index: 1 Month (MODIS)
Isobioclimates (USGS)
Land Surface Forms (USGS)
Surficial Lithology (USGS)
Terrestrial Ecosystems (USGS)
Topo Moisture Potential (USGS)
Health
Malaria Climatological Suitability
Move this Layer to top
Controls | Description | Legend
Transparency
Malaria Early Warning System
Move this Layer to top
Controls | Description | Legend
Transparency
Water
Chlorophyll Concentration: 1 Month (
Sea Surface Temp Anomaly: 1 Month
CREST Model, NRT Soil Moisture
200 km
DeLorme, NAVTEQ, TomTom, USGS, Intermap, IPC, NRCAN, Esri Japan, METI, Esri
China (Hong Kong), Esri (Thailand)

Google Earth Integration

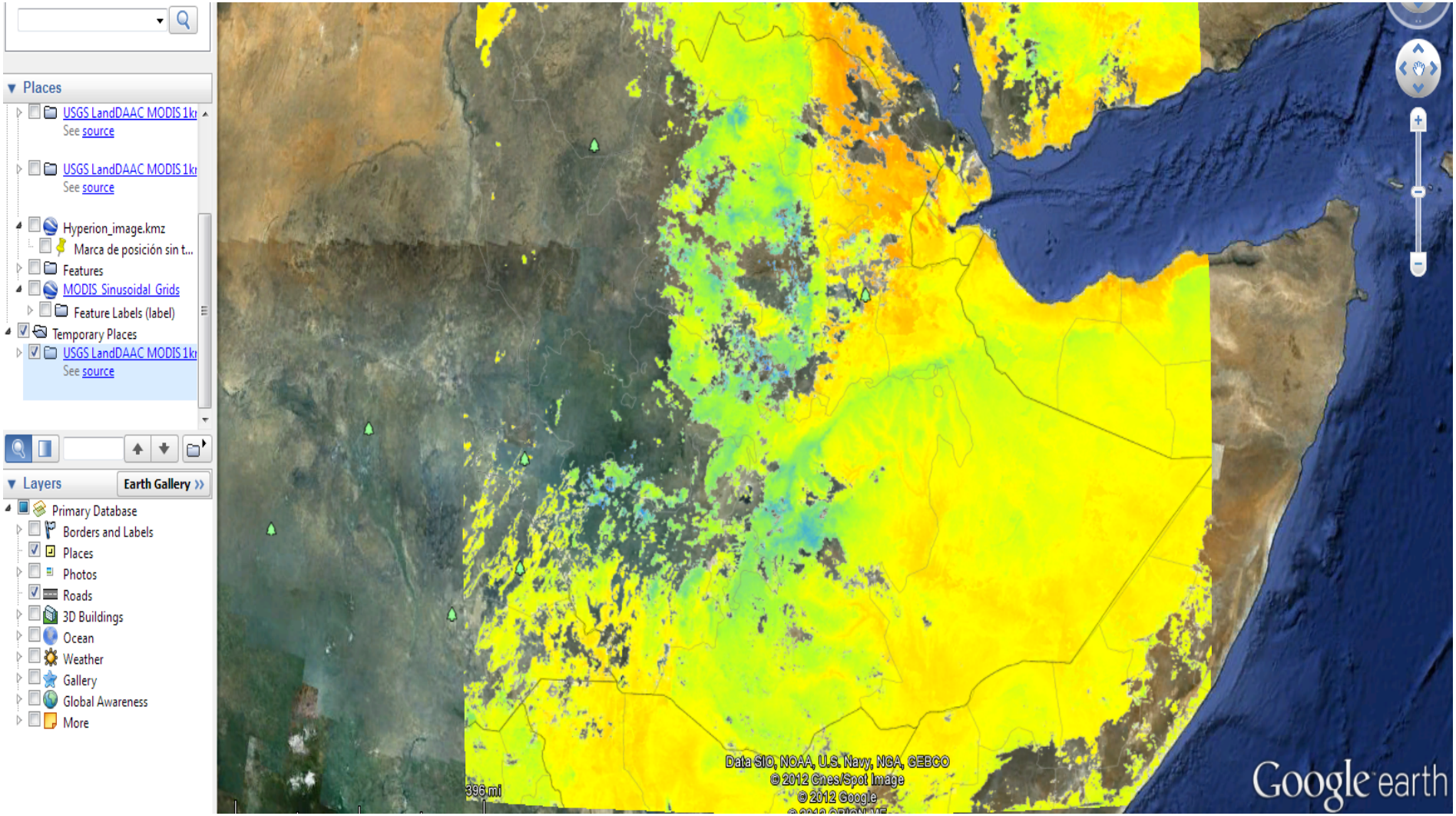


Dataset Documentation

Data: 8 day average MODIS Night Land Surface Temperature image at 1 km spatial resolution from the Aqua satellite.
Data Source: United States Geological Survey, Land Processes Distributed Active Archive Center, Moderate Resolution Imaging Spectroradiometer (USGS LandDAAC MODIS)
Note: There is typically a 8 to 10 day delay between the end of the observation period for the latest data and the date when those data are received and displayed on this page.

Download Map		Download Layer		Download Data
Figure as PDF	Figure as JPEG	KML for GoogleEarth	GeoTiff for GIS	Data for GIS
Colorscale as PDF	Colorscale as JPEG			

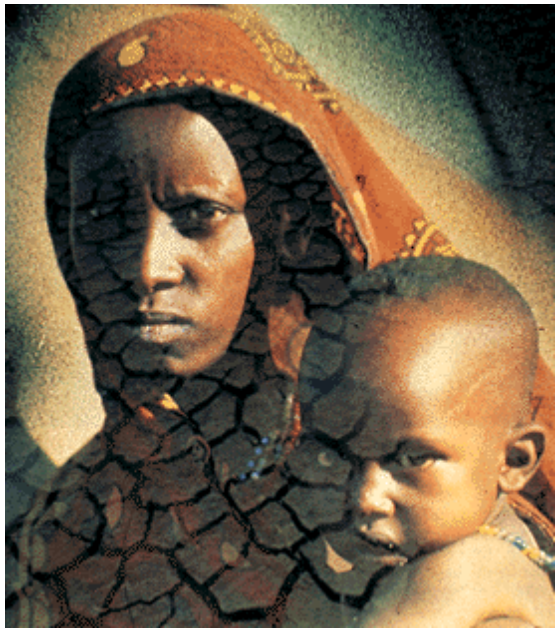
Google Earth Integration



Capacity Building

- IRI Summer Institute (2 weeks) 2008-2009-2010-2011
- In Countries: Brazil, Colombia, Ethiopia, Kenya, Madagascar, Uruguay
- Department of Earth and Environmental Engineering (EAEE) at Columbia University, New York

International Research Institute for Climate and Society (IRI), The Earth Institute



http://iri.columbia.edu